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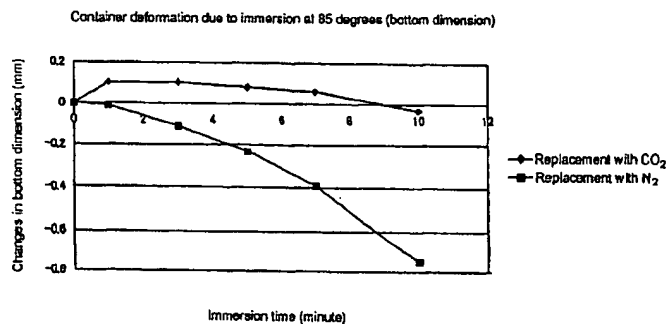
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(54) Title: METHOD OF SERVING HEATED BEVERAGES



(57) Abstract: The objective of the invention is to minimize the deformation of the plastic container filled with beverage that is to be heated to be served. A non-carbonated beverage is filled in a plastic container at a normal temperature. The head space of the plastic container filled with the non-carbonated beverage is injected with carbon dioxide gas to replace a portion of the air in the head space. The container in which a portion of the air in the head space has been replaced with carbon dioxide is sealed with a cap at its mouth. The beverage sealed inside the plastic container is heated to be served to consumers.



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METHOD OF SERVING HEATED BEVERAGES

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to Japanese patent application number JP2002-171443, filed June 12, 2002.

5 FIELD OF THE INVENTION

The present invention relates to a method of serving a beverage contained in a plastic container by heating the same to, for example, 45 - 90 degrees Celsius.

BACKGROUND OF THE INVENTION

10 It is a wide practice to fill beverages in plastic container and heat the same in automatic vending machines, warming devices or the like before serving the same to consumers.

Conventionally, beverages are filled in plastic containers at a relatively high temperatures and are heated before they are served to consumers. If beverages are filled in plastic containers at a high temperature, the pressure inside the containers will decrease at
15 normal temperatures. As such, the pressure inside the containers will not rise too much even when the beverages are heated, and deformation of the containers was avoided.

In order not to impair the flavor of the beverage and the like reasons, it has also been the practice to fill beverages in containers under sterile conditions at a normal temperature.

A problem has arisen anew, however, because in case beverages are filled in plastic
20 containers at normal temperatures, containers would become deformed as the pressure therein will rise as a result of expansion of gas in the head space when the beverages are heated before served to consumers.

SUMMARY OF THE INVENTION

In order to solve the problem mentioned above, the present invention provides a
25 method of serving heated beverages, which is characterized by the steps of:

filling a non-carbonated beverage in a plastic container at a normal temperature,

injecting carbon dioxide gas into the head space of the plastic container filled with the non-carbonated beverage to replace a portion of the air inside the head space,

capping the mouth of the plastic container in which a portion of the air inside the head space has been replaced with carbon dioxide, and

serving the beverage sealed inside the plastic container to consumers by heating the same.

5 DESCRIPTION OF THE DRAWINGS

Figure 1 shows the chronological changes in the bottom dimension of the plastic containers.

Figure 2 shows the chronological changes in the girth of the plastic containers.

Figure 3 shows the chronological changes in the total height of the plastic containers.

10 DETAILED DESCRIPTION OF THE INVENTION

A thermo-plastic resin such as polyethylene, polypropylene, and polyethylene terephthalate is subjected to blow molding, injection blow molding, stretch blow molding or the like to produce plastic containers to be used in the present invention. Plastic containers thus produced and caps are subjected to sterilization treatment using hot water or chlorine-
15 base bactericide and fed to sterile filling device.

Beverages to be filled include non-carbonated beverages such as green tea, Oolong tea, black tea, milk tea, black coffee, milk coffee, and fruit juices.

A non-carbonated beverage is filled in a plastic container using known sterile filling device in a sterile air atmosphere at 5 - 40 degrees Celsius, more preferably at a normal
20 temperature between 15 - 35 degrees Celsius.

In the head space of the plastic container filled with non-carbonated beverage is injected carbon dioxide gas, or a gas mixture containing carbon dioxide and nitrogen gas and the container is sealed with a cap. Thus, the air inside the head space is replaced with carbon dioxide gas. Preferably, 30 - 60% of the air in the head space is replaced with carbon dioxide
25 gas. The air in the head space, particularly oxygen, is preferably replaced with as much carbon dioxide as possible in order to prevent oxidation of the contents in the container. The amount of oxygen content is preferably less than 1 mg/100 ml.

After replacement with carbon dioxide is complete, the plastic container is sealed with a cap, transported outside the sterile filling device, and then supplied to retail shops via customary distribution route.

At retail shops, the containers are heated to 45 - 90 degrees Celsius, preferably to 50 - 60 degrees Celsius in an automatic vending machine with heating device, warmer apparatus, etc. to be served to consumers.

EXAMPLE

Green tea, milk tea, and milk coffee were filled into 280 ml polyester bottles produced by Ishizuka Glass Co. using sterile filling line manufactured by Dainippon Printing Co. Ltd. Immediately before capping, carbon dioxide gas was injected from the mouth of the bottle to replace the air inside the head space of the product. As a control, nitrogen gas was used to replace the air inside the head space of the product under the same conditions.

Filling conditions:

Liquid temperature: 25 - 30 degrees

Filling rate: 600 bottles/minute

Table 1

Product	Replacement gas	Flow rate of gas (NL/Min)	Filling amount (ml)	Replacement ratio (%)	
					Mean
Milk coffee	CO ₂	185	283	30.6 33.3	32.0
	N ₂	230	283	54.3 54.1	54.2
Milk tea	CO ₂	180	283	35.1 41.3	38.2
	N ₂	230	283	57.3 56.6	57.0
Green tea	CO ₂	185	283	46.2 45.0	45.6
	N ₂	225	283	57.3 51.0	54.2

Stability of the contents:

Table 2

Product	Flavor (As compared with Control product)	
	Immediately after production	55°C After 1 week
Milk coffee	No problem	No problem
Milk tea	No problem	No problem
Green tea	No problem	No problem

Heat resistance test:

Bottles filled with green tea in accordance with Example were immersed in a hot bath at 85 degrees, and chronological changes in the bottom dimension, the girth and the total height were measured. The result is shown below.

Table 3

Immersion time (Minute)	Changes in bottom dimension (mm)		Changes in girth (mm)		Changes in total height (mm)	
	Replaced with CO ₂	Replaced with N ₂	Replaced with CO ₂	Replaced with N ₂	Replaced with CO ₂	Replaced with N ₂
0	0.00	0.00	0.00	0.00	0.00	0.00
1	0.10	-0.01	0.11	0.54	0.06	0.13
3	0.10	-0.11	0.23	1.04	0.17	0.38
5	0.08	-0.23	0.30	1.42	0.25	0.62
7	0.06	-0.39	0.40	1.86	0.35	0.98
10	-0.03	-0.75	0.82	2.50	0.53	1.66

The chronological changes in the bottom dimension of the plastic containers are shown in Fig. 1; similar changes in the girth in Fig. 2 and changes in the total height in Fig. 3. The minus of changes in bottom means that the bottom has fallen below.

Effect:

Carbon dioxide gas is contained in the head space of the plastic container provided according to the present invention, and a portion of carbon dioxide has been dissolved in the beverage. The pressure inside the plastic container is decreased to below the atmospheric pressure. As a result, it becomes possible to minimize deformation of the container due to expansion of the gas inside the head space that is heated by heating mechanism built in the automatic vending machine, warmer device or the like.

WHAT IS CLAIMED IS:

1. A method of serving heated beverage which is characterized by the steps of filling a plastic container with a non-carbonated beverage at a normal temperature, injecting carbon dioxide gas into the head space of the plastic container filled with non-carbonated
5 beverage to replace a portion of the air in the head space with carbon dioxide gas, sealing with a cap the mouth of the container in which a portion of the air in the head space has been replaced with carbon dioxide, and heating the beverage sealed inside the plastic container to be served to the consumers.

Fig. 1

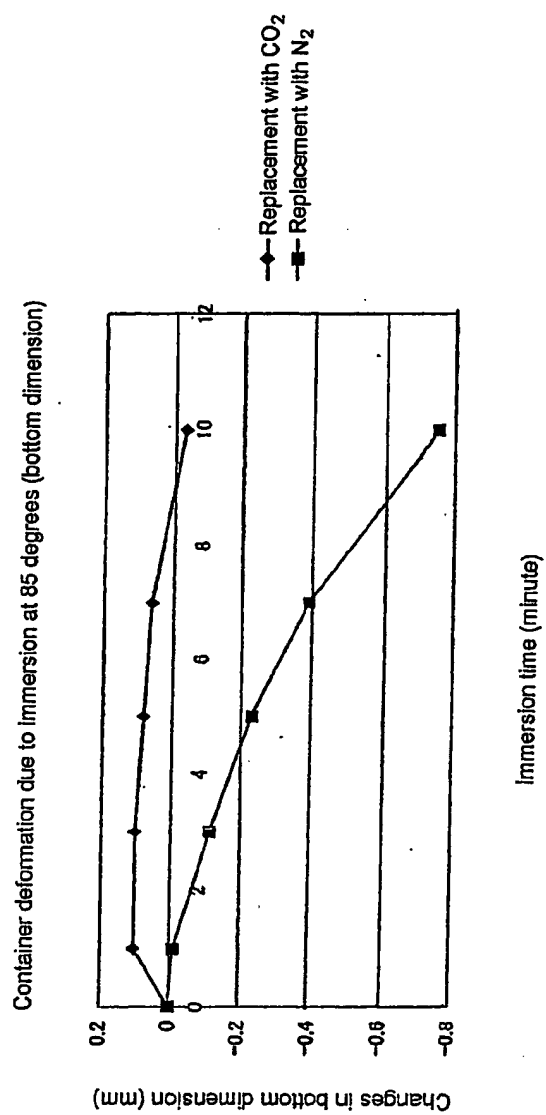
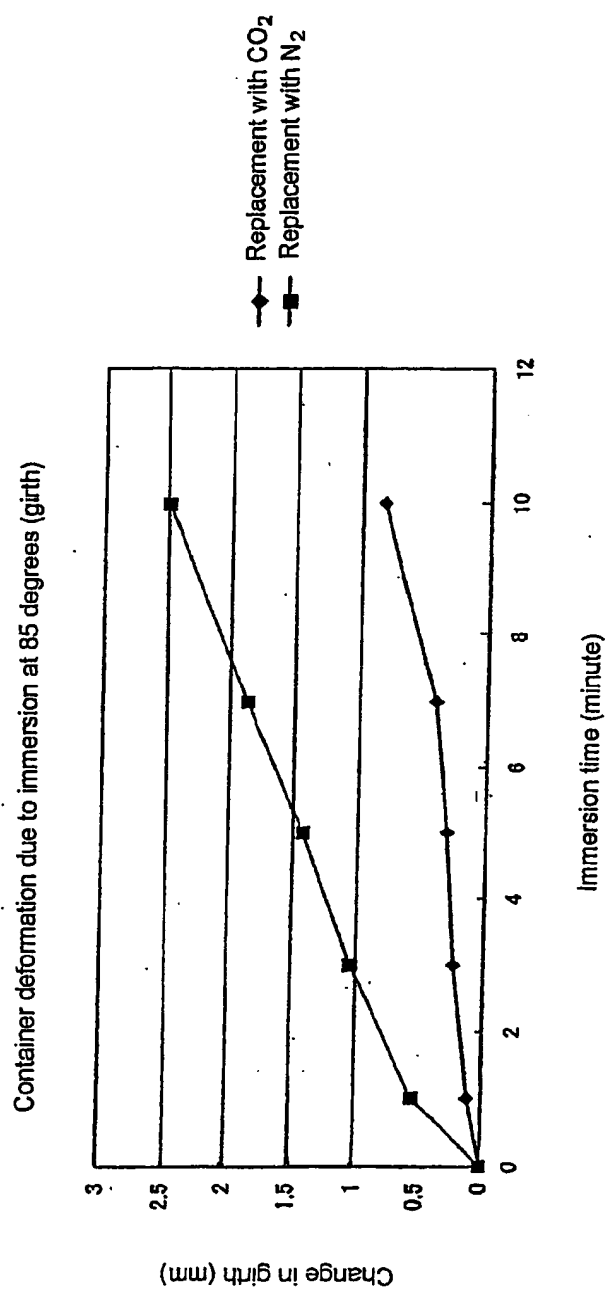


Fig. 2



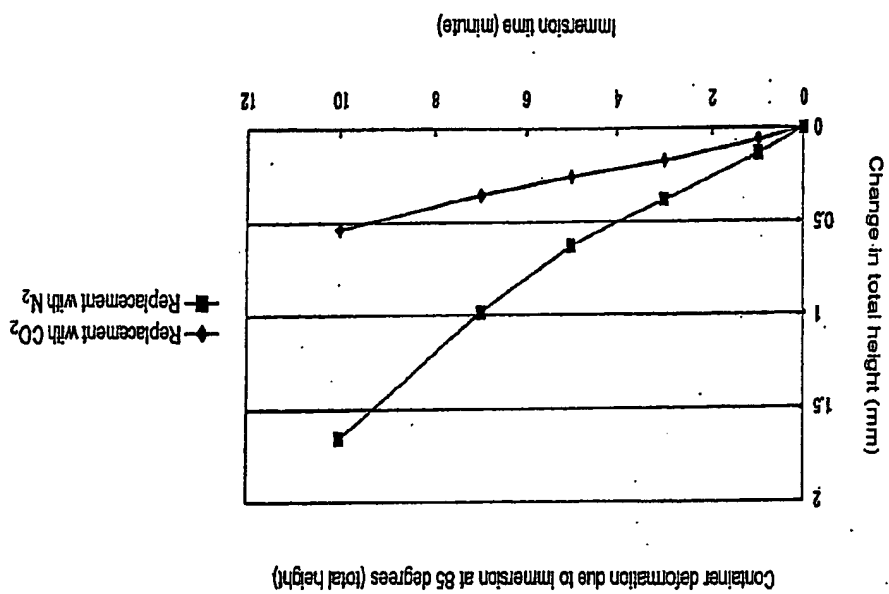


Fig. 3

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B65B31/00 B65B31/04 A23L2/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65B A23F A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal, WPI Data, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	PATENT ABSTRACTS OF JAPAN vol. 2003, no. 07, 3 July 2003 (2003-07-03) - & JP 2003 063571 A (COCA COLA ASIA PACIFIC KENKYU KAIHATSU CENTER:KK), 5 March 2003 (2003-03-05) cited in the application abstract	1
A	US 5 384 143 A (KOYAMA MASAHIRO ET AL) 24 January 1995 (1995-01-24) claim 1	1
A	US 4 805 768 A (SASAKI KAZUO ET AL) 21 February 1989 (1989-02-21) claim 1; figures 4,5,11	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

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